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PLANTING AND MARKETING OYSTERS IN THE PACIFIC NORTHWEST 1/

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On the Pacific coast, two species of oysters form the basis of the industry (Ostrea lurida, the Olympia or native oyster; and Ostrea gigas, the Pacific or Japanese oyster). The Olympia oyster is the small native species, whose habitat extends from British Columbia to California. It is roughly circular in outline and does not attain any great size; and 2 inches in diameter is a fair-sized specimen. This species is cultivated in Puget Sound where, as shucked oysters, as many as 1,600 to 2,000 meats are required to make a gallon, which sells for about $12, wholesale. The Pacific oyster is a species introduced from Japan, sometimes reaching a length of 12 inches or more. The market grades may run as low as 80 meats to the gallon, while for the small, or C grade, the count is 140 or more per gallon. The shell of a good specimen is longer than it is wide, narrower at the hinge end, and broad at the opposite end. An average marketable specimen may be 3 - 4 inches long and $2\frac{1}{2}$ - 3 inches wide. Some single oysters when grown on a hard bottom under uncrowded conditions are nearly circular in outline.

During the gold rush days in California, that area in the State of Washington now known as Willapa Harbor was the center of an active native oyster industry. Shoalwater Bay, as it was then known, was the scene of unprecedented prosperity for the oystermen. Sailing ships made regular runs between Shoalwater Bay and San Francisco with cargoes of the small, native oysters. These commanded the fancy price of $20 or more a plate from the oyster hungry and monied citizens of San Francisco.

But overexploitation of these natural oyster beds ultimately brought about their destruction. No attempt was made to return the empty shells to the beds to maintain their firmness and thus prevent the accumulation of silt and mud which kills the oyster spat. Oysters in mass were gathered onto small scows, brought ashore and sorted for size. The small oysters discarded were thrown in heaps ashore to die instead of being returned to the beds to complete their growth. A good specimen of the native oyster is a rarity there today. The Olympia oyster industry, however, is kept alive at the lower end of Puget Sound by careful "farming."

1/ For commercial handling of oysters on the eastern coast, see Fishery Leaflet 50. (Obtainable from the Fish and Wildlife Service, Department of the Interior, Washington 25, D. C.)

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At Willapa Harbor, ancient shell beds have been revealed by excavations along the banks of the harbor, several feet below the present ground surface. Well-drilling operations disclose other beds still deeper, extending back from the present shore line 25 miles or more. Thus, it is evident that the oyster beds in prehistoric times were of vast extent, and those so ruthlessly exploited during the last half of the nineteenth century were but a small remnant of the ancient stand.

When the decline of the native oyster industry became so serious that the end was in sight, some oystermen experimented with importing eastern oysters (Ostrea virginica) to the harbor, shipping small specimens in refrigerator cars. For a time the venture showed promise but high cost of the seed oysters and other factors combined to cause the decline and final extinction of the transplanted eastern oysters. Japanese oyster workers, familiar with the industry in their homeland, and certain forward-looking oystermen on the coast, later experimented with the Japanese oyster (O. gigas). From the time of its introduction the species took hold rapidly and the industry reached the point in 1941 when in Washington alone, 178,000 standard cases of these oysters were steamed and canned. In addition, great quantities were sold on the fresh market. The Japanese oyster was introduced to other areas on the coast and today it is found all the way from British Columbia to California. An attempt has been made recently to cultivate this species in Alaska, and reports indicate it may live there. Whether growth will be slower and spawning fail to occur in the colder northern waters has not yet been determined.

Cultivation of the Pacific oyster formerly depended upon the yearly importation of seed from Japan. The seed was shipped either on whole or broken shells and was packed in wooden cases holding about two bushels. It usually arrived from Japan in May, having been carried on the ship's upper deck and occasionally wet down with salt water. The seed was sold on a guarantee that the case contained a given number of live, healthy oyster seed - about 15,000 or 20,000. The price of seed varied from year to year but was about $5 per case. The oyster grower would purchase seed in proportion to the size of the area he wished to plant, the average seeding being around ten to fifteen cases per acre. The seed was set upon beds of oyster or clam shells.

For a number of years it was thought that the Pacific oyster would not spawn in our waters, and the Japanese seed producers encouraged that belief. In 1936, however, temperature conditions were ideal, the oysters had probably become acclimated and a good set took place. Willapa Harbor was covered with spat to such an extent, in fact, as to be a nuisance to some of the growers who, in paying for gathering oysters by the bushel, found that the spat on the marketable oysters decreased the number of grown oysters to the bushel and, as a result, tonging costs went up. Since that year, the Pacific oyster has spawned in other areas on our coast.

When the war cut off seed importation from Japan, oyster growers had to depend upon locally-grown seed. Each year oyster shells, strung on wire, are hung upon racks in favorable areas for the catching of spat. Spawning varies from year to year, depending upon water temperature and other factors; in 1943, for example, there was a near failure resulting apparently from low water temperatures during that summer.

To plant the imported seed, the cases were broken open and the seed dumped upon small scows. These were towed across the area to be seeded between lanes of stakes or willows which marked out the sowing areas. Men on the scows broadcast the seed with shovels, attempting to spread it as evenly as possible.

Seeding grounds should be areas protected from storms as the seed on the shells is easily moved about or washed away. Ground with silt or mud tends to hold the seed, but silt or mud in excess will smother it. As the oysters grow and increase in weight, they may be moved to more exposed and possibly better growing areas.

Growers who take the best care of their oysters follow the practice of "breaking." Many small oysters will be found on one seed shell. As these grow, some will die but there may be too many for best growth. When crowded, the oysters, not being able to expand sideways, grow long and illshaped. When the oysters are old enough to survive the process of breaking, the grower sends men over the ground at low tide when the beds are exposed. These men, equipped with small wedge-shaped hammers, turn the clusters over and strike the old seed shell at the base of the cluster, thus shattering the cluster. For best growth, single oysters are preferable, and no more than three oysters should be left with a single attachment. Owing to the high cost of labor, hand-breaking is being discontinued and some operators pass a drag across the bed at high tide. The drag tends to turn the clusters over and break them apart. As the shell of the Pacific oyster is not very strong, some oysters are killed by "breaking."

The Olympia oyster is cultivated in tidal basins formed by low concrete walls to hold water at low tide. Beds are carefully formed of old shell within these enclosures, so that the bottom shall be firm and free from mud. A bottom of silt would cause heavy mortality.

Oysters are gathered from the beds by three methods. Where the beds are covered with water, as at high tide, tonging and dredging are used. At low tide on a dry bed the oysters may be gathered by hand. Tonging makes use of an implement known as "oyster tongs," built much like two rakes hinged together with the teeth opposed. By standing in a boat the operator may, by lowering the tongs to the bottom and feeling about, locate the clusters. The handles are then brought together and the oysters hoisted to the surface. If the water is clear and not too deep, the process of finding the oysters is easier but, in any event, some skill is needed to operate the tongs properly.

Where the oysters are cultivated on beds that go dry with the tide, hand picking is used. The oyster operator goes over the bed at low tide and selects places where the oysters are plentiful enough to fill a boat. Two poles or willows are set up several yards apart to mark the "setting." Sufficient distance between the markers is left to allow a boat to be anchored between. The workman then throws aside the oysters between the stakes where the boat would come to rest to prevent them from being crushed or forced into the mud by its settling. As many settings are made as there are men to pick oysters and boats available to load. At high tide, the boats are towed over the beds and the man on each casts off and poles his boat over to the setting assigned to him. While waiting for the tide to

fall, he may tong oysters; but as soon as the boat grounds, he gathers the oysters into a bushel basket made of heavy galvanized wire. The oysters are dumped upon the boat until the setting is cleaned or the boat loaded to capacity.

The type of boat used may hold from 75 to 100 bushels. One that holds 100 bushels when loaded level with the side boards, or "combings," is said to have a "double-combing" load if piled high enough to hold 200 bushels.

Picking and tonging are paid for by the bushel. The rates have gone up the past few years from 4¢ to 11¢ per bushel. With a good setting, a picker or tonger can gather 200 bushels or more on a tide.

Owing to the scarcity of help, however, dredging has largely taken the place of picking and tonging. Dredgers may be self-powered or towed behind another boat. They may be operated from one side only, or from both sides, or from the stern. If more than one drag is to be fished, a separate hoist is used for each drag so that one may be pulled in while the other is fishing. Some dredgers are merely boats with a long foredeck where the oysters are piled as dredged; others are power scows with side boards. As the latter have a more shallow draft they hold larger loads and may fish longer over the beds without going aground.

Oysters are delivered to the opening house from the dredges by means of a chain elevator or a bucket hoist. In some houses the oysters pass through a rotating cylindrical washing-screen which removes all sand and grit, and passes the oysters to the storage bins. These bins are built above the concrete-surfaced opening tables and are tapered toward the bottom. The oysters fall through the narrow opening at the bottom onto the opening table and, as the oysters are removed by the opener, the supply is continually renewed.

An opener's outfit usually consists of an oilskin or rubber apron; boots; gloves; and an oyster-knife. The opener grasps the oyster in his left hand, with the top shell of the oyster uppermost and the hinge end to the rear. The point of the oyster knife is inserted between the lips of the "bill" or large end, about a third of the way back and on the side next to the opener. When opposite the large muscle, the knife is forced inward and given a sideways motion which cuts the muscle loose from the shell. The shell is then pried off and discarded through an opening in the table. The meat is cut loose from the remaining half of the shell and dropped into a pail.

A good opener will remove oyster-meats without cutting or tearing them. "Cuts" must be graded out and bring a lower price. Payment is made by the gallon, and may range from 25¢ to 45¢ for the Pacific oysters. For the small Olympia oysters, the rate is in the same range per quart. A man known as the "checker" removes the pails as filled and punches a double ticket held by the opener. At the end of the day, one half of the ticket is held by the operator and other half retained by the opener.

The meats are placed in a bubbler or washer and stirred about in water through which compressed-air bubbles are passed, thus removing sand and silt. The meats are then delivered to a metal grading table where they are sorted for size and dark meats are discarded. Pacific oysters are graded thus:

Grade	Price 2/
AA count 80 or less per gallon	$2.65
A " 80 - 110 per gallon	2.90
B " 110 - 140 per gallon	3.15
C " 140 and over per gallon	3.25
Olympias: 1,600 to 2,000 per gallon	11.10

Shell stock, or oysters to be marketed in the shell, are shipped in sacks holding about two bushels. Shipments to opening houses located in cities a hundred miles or so from the producing areas are made in bulk in open-bodied trucks. Most opening houses, however, are located near the point of supply.

In the State of Washington, opening houses are subject to State inspection, and an operator must comply with State sanitation requirements as to construction and operation; and be granted a permit to operate. This permit carries a number which must be placed upon each sealed container of oysters shipped. Original packages of shucked oysters which go direct to customers are sealed with a cover bearing the permit number which is destroyed in opening the container. Interference by intermediate handlers who might "float" the oysters and thus increase their volume, and then repack them, is thereby prevented.

Before the wartime tin shortage, large quantities of fresh-shucked oysters were marketed in No. 10, one-gallon tin cans. These were packed 6 or 12 in a wooden box and covered with crushed ice for long shipment. For shipment from an opening house to a repacking house, a hundred miles or less, from the coast, 5-gallon metal cans with press lids were used. These were returnable. Containers of this type were used particularly where a fish house in Seattle or Portland had an opening house located on the coast and did all of the repacking into smaller containers at the city plant. Now, with a shortage of tin, producers have had to turn to waxed-fiber or glass containers, ranging from one-half pint to one gallon capacity. To the extent permitted by government regulations and emergency allotments, the producers are using enameled bonderized or blackplate metal containers.

No standard-sized wooden box is used for holding the smaller containers and ice in shipment. Most fish houses choose a size that will hold a given number of containers and ice to best advantage. A box 16" x 26" x 6" will hold about 33 glass pints and allow for sufficient

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2/ Prices during fall of 1942, according to Pacific Fisherman Yearbook, 1943. The weighted average price per gallon for all sizes during 1942 was $2.20 for Pacific oysters and $9.50 for Olympia oysters, according to the Seattle Fishery Market News annual summary for 1942, Fish and Wildlife Service.

crushed ice. The proportions of various-sized containers employed varies with the shipper; one operator reported that he used one-half of one percent of half pints, forty percent of pints, two percent of quarts, and the remainder, gallon cans. These shipments were sent as far as Los Angeles, Calif., and Butte, Mont.

Where a carload shipment is made, a refrigerator car is used; smaller shipments are sent by express as all fish shipments are piled in one end of the baggage car, and dry ice placed on top; the pile is then covered with a tarpaulin. Auto trucks refrigerated by dry ice or mechanical refrigeration are also used to a great extent.

In steam canning, the oysters are freed of sand and mud in rotating washers and sent to storage bins or dumped directly into metal slat cars, running on light rails. Cars enter a horizontal iron retort with doors at each end. The oysters are steamed about ten minutes at 230° F., and the cars run through the retort and placed before the openers who may open directly from the car. Opening is much easier with steamed than live oysters, and the payment rate is lower, about 11¢ per gallon. The meats are dropped into 10-quart pails which contain two quarts of water; this prevents the air from acting on the hot meats and turning them brown. As the pail is filled, the water rises and keeps the meats covered. The opener is paid on the basis of two gallons to a pail.

Filled pails are taken to a washer where the meats are agitated under water with compressed air, then, graded for size at the grading table. Oysters on the Pacific coast are packed in the 301 x 411 size salmon-can and the 211 x 400 eastern oyster, or picnic-size can. The "salmon tall" may contain large oysters, running only 5 to 8 per can; or "mediums," 8 to 12 per can, although the number may vary somewhat with the packer. The picnic size is reserved for small oysters which will run 8 to 12 or more in the smaller can. Cut or torn oysters are usually packed in the larger cans and sold as "cuts."

Meats are weighed into the can by "packers" who fill the can partially full and then set it upon the scales and add oysters until the correct inweight is made up. Cans are then set upon a conveyor which carries them under a brine tap where hot salt brine is added to overflowing. Salt pellets also may be used and hot water added until the can overflows. A 60-grain pellet is used for the 301 x 411 can, and a 35-grain pellet in the picnic size.

As the can enters the seamer, the cans are tipped slightly. This allows some of the liquid to drain off and gives each can a uniform headspace. Inweight will vary with the degree of fatness of the oysters. As a definite cutout weight is required and oysters shrink in processing, the inweight will be more than the cutout weight: for instance, the cutout weight for the 301 x 411 can (pre-war weight) was 8 ounces, and the inweight might vary from 9 to 11 ounces, depending upon the fatness of the oysters. To conserve tin, the cutout of this size can has been increased to 12 ounces or 50 percent. The picnic size formerly had a cutout weight of 5 ounces which has been increased to 7½ ounces.

The sealed cans are processed at 240° F. for 35 minutes. The cans are partially cooled in the retort by being flooded with cold water. Cooling and drying are completed in the warehouse.